Building International Bridges to Space

Keynote Address to 2006 JUSTSAP Symposium

"*Expanding Japan-U.S. Collaboration in Space*"

November 13, 2006

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Aloha. Welcome to this forum where scientists, educators, business leaders, and government officials from around the world have the opportunity to explore methods to exploit space. I am truly honored to address such an outstanding group.

The human space business environment is changing. As Spencer Johnson reveals in his best selling book “Who Moved My Cheese?” - Someone is moving our cheese and we are having some fun deciding what to do about it. The next 10 years in space will prove to be one of the most challenging and rewarding periods since the decade of the 60’s. Big changes are occurring in the government market and the private market will probably establish a space tourism industry as a financial base on which to grow. Look at just a few items on our burgeoning space agenda.

- The space shuttle will retire after performing >140 flights in 30 years.
- The Soyuz family of vehicles will continue its yeoman ship task of delivering humans safely to low earth orbit.

- The ISS will be fully built enabling the international community to conduct critical research in a pure vacuum and acceleration free environment.
- Re-supply missions to the ISS will consist of vehicles provided by Russia, Japan, ESA, and for the first time – private operators through the Commercial Orbital Transfer System (COTS). *More about this later.*
- Space Tourism, now just a novelty for a few people, will develop into an affordable market for many.
- Private corporations, using private funds, will provide new launch vehicles and a sustainable private launch market will develop.
- Space Ports will be established in multiple locations. NM, OK, & HI to name a few. There must be a potential market because the mantra - “If you build it they will come!” - does not satisfy most business cases, even for the most intrepid space entrepreneur.
- NASA will build Orion and Ares 1 and press forward with the VSE (return to the moon). The big story here is “Who will build

and maintain the in-space and lunar infrastructure – government or private ventures?”

- Burt Rutan will undoubtedly be ahead of the pack with a new spaceship design that is elegant in performance yet simple in operational efficiency.
- And Bob Bigelow may get his first paying customer at his space hotel. The customer will probably be delivered by Virgin Galactic Space Ways.

This is not all that will happen in the next 10 years in space. The market is poised for expansion and entrepreneurs will fill the void with new concepts. The next 10 years will be one of fulfillment for those who have been pushing the envelopes in personal space travel and private rockets which should not be subject to the onerous government rules, dictates, and overly conservative specifications. We may achieve what we all want – access to space for the greater populace. This should raise the awareness level of the general public and encourage them to open their wallets and pocketbooks.

I have given you a rather long introduction to what I am going to talk about today. Trust me; I will stay within the time allowed. I will talk about some of these new frontier possibilities as I address some of

the challenges or barriers we may face in this expanding international market opportunity. I will propose 6 Rules, advisory only, to mitigate the impacts these challenges may have on a new frontier market. One of our goals as we move forward to develop and harvest the private space market should be active inclusion of the international community as we Build an International Bridge to Space. This will be challenging, but the harvest will be more plentiful. Forums, such as this conference, enable a better harvest by expanding the sharing of knowledge between Japan and the United States. Take advantage of the opportunity for cooperation that this conference provides.

Space travel is a hard enough challenge by itself, but if we are to be successful in expanding the commercial for-profit transport of people to low earth orbit and beyond – we must treat this business opportunity as an international market. This presents us with additional challenges and corresponding opportunities. The assumed "language barrier" is not really a barrier because successful businesses have already reduced that barrier to rubbish. There are many other international (and domestic) barriers that we will face. Today I will focus only on the political, legislative, and legal hurdles which we must safely and efficiently navigate. At the same time we

must not make light of the tremendous technical challenges that exist in lowering design, manufacturing, and operational costs while maintaining a high quality, low risk mission profile that people will feel comfortable buying a ticket to ride. Something that provides a reasonable amount of assurance to the paying customer that they will survive to share their stories and digital pictures with other. Thus the market grows!

Space Adventure's, INC. does just that today, but for a very select few who can offset the multimillion dollar cost. To date, four people have paid to ride a rocket on a trip to the ISS. These four had a reasonable assurance that they would return safely to earth – due in large part because they were riding a mature vehicle in a proven operating environment.

We must learn lessons from both the private and government international ventures. We must apply sound engineering and business acumen at all times to create a trusted product line and ensure development of a market. Now let's talk about the barriers.

Political Barriers

What about the political barriers? These are truly international in flavor. The recently announced US Space Policy of the Bush

Administration should leave no doubt about the political importance attached to access and use of near space to protect the national interests of the United States. Other nations undoubtedly feel the same – creating the political barrier. One can say “Whoever controls the high ground has the best view of the scene and can plan and execute a course of action which is better, cheaper, and more effective.” I suggest that this political barrier exists and we are powerless to break it down. We must develop the business within the constraints that this barrier places on operations.

Some might propose a United Nations policy to mitigate this barrier to private international space business. I suggest the UN is ineffective in dealing with international conflicts. They fuss over defining the issue; debate the issue to no one in particular; then, if they can get consensus, they might issue a non-binding resolution. So what!

As an entrepreneur, recognize the political barrier exists. Try to avoid getting near this barrier and move on. Try not to “live on the edge” of this barrier. I know living on the edge is a daily way of life with this crowd.

ITAR is an example of a political barrier. Sometimes I think ITAR really means Innovative Techniques to Adapt Restrictions.

1st Rule – Avoid falling within the purview of ITAR.

2nd Rule – If you can't avoid ITAR, then in football parlance – try a quick kick to gain field position (quarterback punt on third down to surprise the opposition). As you can surmise, this rarely works.

The good news is the political barrier is highly visible and can be avoided.

The Legislative Barrier

The legislative barrier is truly scary for it can be applied at many levels (local, state, national, international); is almost always incomprehensible; and it has many loopholes. These loopholes ensure future legislative actions to close the loopholes by creating more loopholes. This barrier, much like weeds in the yard, needs to be treated with a pre-emergent to limit its growth. Notice I didn't say eliminate – we can only hope to reduce the growth of legislative controls (or barriers). One of the fundamental faults is asking for legislation to help open a new frontier because recent history shows the opposite effect will result. The days of granting unlimited rights of way to encourage rail roads to develop a critical infrastructure are gone forever. Today, if we were to apply a similar thought process to opening private launch facilities with land grants, I suggest we would

probably get environmental, noise, and other legislation “to help us”. To be fair, the three states I mentioned are helping to establish space ports in anticipation that peripheral business will develop and provide increased tax revenues. The free market once again proves its value. I ask you to ponder this question – why do you want to legislate a new frontier market? Rules (laws) are typically made when someone errs - so laws are passed in an attempt to prevent any future transgressions.

3rd Rule – Don’t screw up.

Convince your legislative friends to do nothing about regulating private space ventures. Better yet, don’t tell the legislators what you are doing. Let the open market guide the process. Just follow the laws currently in place. Let’s call this Rule #4.

I know some of you may assume that the award of COTS and the aid to establishing space ports is good legislation. I disagree! These are policy decisions within the current legislative structure. Wait until something goes astray and then you will see new legislation. This legislative barrier exists in all nations.

The Legal Barrier

The legal barrier feeds on the legislative barrier. After all, if you legislate new laws then lawyers will be required to interpret the new laws. The lawyers are also there to find ways to comply with existing laws. This is a good outcome. My suggestion is keep the lawyers busy finding innovative ways for your business to comply with existing laws. Measure their performance against profit and loss criteria. That will keep them busy for a while.

Legal barriers can be onerous and almost always require a lot of time to find solutions. Human space is a high risk business by any measure. Liability will drive considerable cost – so much that liability may be the cost driver of the business. Learn how Space Adventures deals with this. I don't know what they do, but they must deal with significant international exposure.

Technical Barriers

The technical barriers are awesome, but you are finding solutions to the most daunting. I don't intend to discuss the technical barriers in any detail. I recognize you are smarter than me as you face these problems daily. I will say, attacking the technical barriers is fun for engineers. Most of us are engineers who thrive on crunching

numbers and finding solutions. (The rest of you want to be engineers) This barrier can be reduced – solutions can be found. International cooperation knocks down this barrier every day. The universal language of numbers and equations is a solid foundation to find the best and the brightest wherever they live. I recall an event from my graduate school days at Georgia Tech. I was enrolled in a course that consisted of me and two students from mainland China. The professor was writing multiple equations on the board and speaking English. I had no clue what he was talking about, but the Chinese students apparently did even though they didn't speak English. I had a discussion with the professor about dropping the course. He encouraged me to stay on by explaining that the Chinese students may not speak English, but their first language is math. Then he added - they already have PhD's. They are just auditing the course. I finished the course #1 of 1. Wow!

We must recognize that technical challenges in a truly international business will require increased quality management and surveillance. ITAR will impact the business case by the mere requirement to monitor the exchange of technical data between non-US persons. It seems like a small detail, but design and manufacturing centers

around the world must use the same measuring standards, metric or English units, and they must use compatible software design tools. Airbus learned this lesson the hard way. They apparently were designing and manufacturing different sides of the same A380 fuselage interface at two separate manufacturing locations and their software tools were incompatible. The impact is enormous.

5th rule – Pay attention to the past mistakes or you will pay.

That concludes a very brief discussion of some barriers that may impact the growth in the next ten years of non-government sponsored near space adventures (or businesses). Now I will discuss " chasing the private space venture cheese" or in other words "What private space venture opportunities may open in the next ten years?". I believe there are two distinct paths for growth in this business within the next ten years. These paths will define the space frontiers for the next generation. Building an International Bridge to Space will be an integral part in the success of each path. The two paths will ultimately be supportive of each other, one will supply the sustaining financial base while the other path will provide the inspirational results that will keep people in the sustaining base motivated. The two paths are not

unknown. The first is private operation of government projects. The second path is defined by purely private ventures.

The first path is characterized by the contract award by NASA for COTS development. This is recognition by NASA that other providers of in-space services do exist and these providers can support the ongoing operations of the International Space Station at a much lower cost. Two small companies, SpaceX and RocketPlane-Kistler, won similar awards to develop an orbital transfer system for resupply of the ISS. The system consists of launch vehicles, orbiting pressurized modules, and a transfer vehicle. The key to success of these ventures is how they can keep the costs low and operate as a product provider to NASA instead of a subcontractor providing a service. The distinction may not be clear. A product provider would deliver the defined product to the destination in a vehicle of their choice, designed to their standards, with the interface to the ISS being the only component that NASA standards can control. A service provider is one using a NASA defined system for delivery that the provider is merely operating. The distinction is real. The product provider can decide the equipment specifications required to deliver the product. For example, a lower level of redundant systems may be

acceptable which will reduce costs. The service provider would probably be required to meet all levels of redundant systems per NASA specifications. COTS will be an early test of how serious NASA is about purchasing truly commercial products and services to support the ISS. COTS can be the space equivalent of FedEx, UPS, DHL, etc. if a competitive free market is allowed to develop. If the market cannot be sustained, the government can always step back in.

Other opportunities for private enterprise operation of government assets will develop as the COTS model matures. This will only remain a viable growth opportunity if SpaceX and RocketPlane-Kistler are truly allowed to provide a private product delivered to the customer in orbit, thus establishing a capability. I propose just a couple other examples where the industry is mature enough to provide highly efficient operations of a government owned business. For example:

- Build and operate the next generation space communication system based on an internet protocol architecture where every vehicle is a node in the net.

- Expand COTS capability to supply a logistical waypoint in low earth orbit where vehicles enroute to the moon can obtain their consumable supplies.

An IP based communication network opens endless possibilities. Communication can be made from any location on earth to any node in the system. Researchers could have instant access to their data. Non-intrusive interactive control of their experiment packages could become a reality. Controls can easily be placed on access in a secure environment. The banking industry handles millions of secure transmissions hourly.

The logistical waypoint in space could also provide supplies to the space hotels. I leave you to think of other possibilities.

The second path for future business in space is not well defined. The faint of heart will not freely venture into this arena. Space tourism will be the cornerstone and foundation for establishing this market. It will be an entertainment market which the private sector is more than capable of turning into a profit making business. Space Ports and private rockets will form part of the infrastructure for this growth industry. It will take a special breed of people to make this path successful.

I would like to recognize those few individuals who will make private space ventures a reality. I won't list them by name except for a couple I know personally. Rather, I will categorize them. They are the group known as space entrepreneurs. They come in all shapes, sizes, nationalities, sexes, etc. I admire this group for what they have accomplished to date and I revel in what they will accomplish in the future. I don't pretend to know what makes an entrepreneur wake up each day willing to risk all they have to pursue an idea. I do know these entrepreneurs all have a clear vision and they display a passion with courage to make the vision a reality. Vision, passion and courage define this group. Chuck Lauer and Mike Kearney, who are in the audience today, display these characteristics. I met both of them about 10 years ago. Chuck was really out there on the edge. His dream of rocketing private citizens to orbit to experience the wonders of free falling around the world is coming close to reality. He is taking RocketPlane-Kistler to the next level. Mike Kearney is, in my opinion, the leading expert in providing commercial space products to a government program. His company, SpaceHab, established the market for providing commercial payload services to NASA and also opened the market for the sale of in space resources to private

buyers. These two individuals personify the entrepreneurial spirit. I encourage you to talk with them during this conference.

In summary – I discussed my views on how opportunities within the human space business will change in the next decade and I presented some barriers to change. I proposed 6 rules to deal with the barriers. As a review –

Rule #1 – Avoid ITAR

Rule #2 – If ITAR cannot be avoided, perform a quick kick

Rule #3 – Don't screw up

Rule #4 – Don't ask for legislative help

Rule #5 – Pay attention to past mistakes or you will pay

And, for the first time, for those who were counting –

Rule #6 – In all you do, HAVE FUN

It is time to open the human space frontier to private entities. This should be an international effort, but we in the United States must first look inward. Launching and supporting humans in space has a national agenda and is generally considered by the government to be too risky to turn over to the private sector. Nuclear power generation also had a national agenda and was viewed as high risk to public

safety, but this government business was released for private development in a highly regulated environment. It is about time to do the same for the low earth orbit market.

I leave you with this thought – maybe we have learned enough in the last 46 years of government operations that we can open the private human space market without a highly regulated environment. Let the market decide. Thank you for your time and remember Rule #6 – In all you do, have fun.

Aloha!